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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/511,734
Filing Date: October 18, 2004
Appellant(s): PROTIC ET AL.

Matthew A. Smith
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 1 December 2008 appealing from the Office action mailed 15 April 2008.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

HAMACHER *et al.* Performance of position-sensitive germanium detectors in nuclear reaction experiments, Nuclear Instruments & Methods in Physics Research, Vol. A295, no. 1-2 (October 1990), pp. 128-132.

LUKE *et al.* Amorphous Ge bipolar blocking contacts on Ge detectors, IEEE Transactions on Nuclear Science, Vol. 39, no. 4 (August 1992), pp. 590-594.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1 and 3-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hamacher et al. (Performance of position -sensitive germanium detectors in nuclear reaction experiments, Nuclear Instruments & Methods in Physics Research, Vol. A295, no. 1-2 (October 1990), pp. 128-132) in view of Luke et al. (Amorphous Ge bipolar blocking contacts on Ge detectors, IEEE Transactions on Nuclear Science, Vol. 39, no. 4 (August 1992), pp. 590-594).

In regard to claims **1**, **3-5**, **7**, and **8**, Hamacher *et al.* disclose (Fig. 1) a camera with a position-sensitive detector for measuring charged particles comprising a crystalline substrate formed of semiconductor material (*e.g.*, high-purity germanium) and a surface region, the surface region comprising blocking contacts (formed by boron ion implantation) with a structured, metallic layer comprises Al (aluminum) disposed above it, wherein the structure of the metallic layer continues through the blocking contacts and at least partially into the crystalline substrate (see "transferring the structure into the semiconductor material by etching" in Fig. 1). The detector of Hamacher *et al.* lacks that each of the blocking contacts comprise a germanium (or silicon) amorphous layer disposed on the crystalline structure, wherein the amorphous layer is not doped. Luke *et al.* teach (section 1) to apply an undoped germanium amorphous layer (that forms good bipolar blocking contacts) on a p- or n-doped germanium crystalline

semiconductor structure as an equivalent alternative to a boron doped layer. Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to provide an undoped amorphous germanium layer instead of the boron doped layer for each of the plurality of blocking contacts in the detector of Hamacher *et al.*

In regard to claim **6** which is dependent on claim 1, Hamacher *et al.* also disclose (section 3.1, last paragraph on the right column on pg. 129) that the structure is formed from segments having a mutual spacing of less than 100 μm.

In regard to claim **9** which is dependent on claim 1, Hamacher *et al.* in view of Luke *et al.* is applied as in claim 1.

It is noted that claim 9 recites that the camera is a tomograph or compton camera which appears to be mere statements of purpose or use and does not appear to imply any additional structural limitations of the camera with a position-sensitive detector as recited in claim 1. Appellant is advised that should claim 1 be found allowable, claim 9 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

In regard to claims **10** and **11** which are dependent on claim 6, Hamacher *et al.* also disclose (section 3.1, last paragraph on the right column on pg. 129) that the mutual spacing is less than 100 μm (*e.g.*, less than 20 μm).

In regard to claim **12**, Hamacher *et al.* disclose (Fig. 1) a method of producing a position-sensitive detector for measuring charged particles, comprising: providing a crystalline substrate (*e.g.*, high-purity germanium); forming a blocking layer on the substrate by boron ion implantation; disposing on the blocking layer a metallic layer (*i.e.*, aluminum); removing portions of the metallic layer, the blocking layer and the crystalline substrate such that at least one structured electrode is formed (see “transferring the structure into the semiconductor material by etching” in Fig. 1). The method of Hamacher *et al.* lacks that forming the blocking layer comprises disposing on the substrate an amorphous Germanium layer. Luke *et al.* teach (section 1) to apply a germanium amorphous layer on a p- or n-doped germanium crystalline semiconductor structure, in order to obtain good bipolar blocking contacts. Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to provide an undoped amorphous germanium layer instead of the boron doped layer in the method of Hamacher *et al.*, in order to obtain good bipolar blocking contacts.

Claim 8 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Amended dependent claim 8 recites the limitation “wherein the amorphous layer is not doped”. Appellant argues that support for this amendment may be found at pg. 6, line 11 to pg. 7, line 10. The specification states (pg. 6, line 11 to pg. 7, line 10) that “Very good

results have been achieved with an amorphous layer made of germanium. … The crystalline region beneath the amorphous layer then preferably also consists of germanium. … The amorphous layer is always applied to a semiconductor material. The amorphous layer therefore provides an electrical conductivity, which is substantially smaller than the conductivity of the material disposed beneath the amorphous layer. In one exemplary embodiment for the manufacture of the invention, an amorphous germanium layer is initially applied by sputtering or vapour deposition. … metallic layer … is subsequently applied by vapour deposition. … Grooves are etched in the amorphous germanium-metallic layer to such a depth that they extend at least into the germanium crystal region … ". Thus there is no express disclosure in the application as filed that the amorphous layer is not doped. While there is no *in haec verba* requirement, newly added claim limitations must be supported in the specification through express, implicit, or inherent disclosure (MPEP § 2163). Further, the passage cited by appellant as support for the newly added claim limitation also does not appear to contain an implicit or inherent disclosure that the amorphous layer is not doped. Therefore, the newly added claim limitation was not described in the specification as filed.

(10) Response to Argument

A. Background

Independent claim 1 recites:

> A position-sensitive detector for measuring charged particles comprising a crystalline substrate and a surface region, the surface region comprising an amorphous layer with a structured, metallic layer disposed above it, wherein the structure of the metallic layer continues through the amorphous layer and at least partially into the crystalline substrate.

This is illustrated in Fig. 2 of the specification:

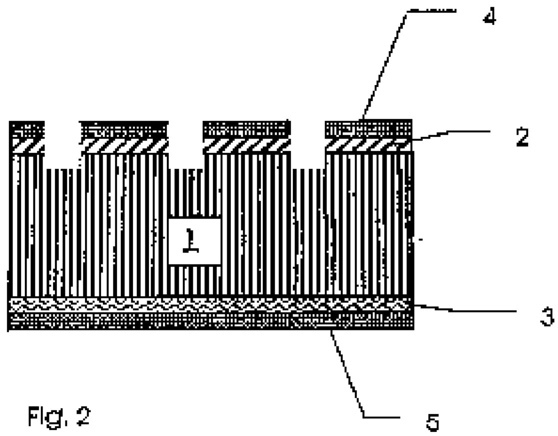

Fig. 2

B. The Cited Prior Art

<u>Hamacher *et al.*</u>

A substantially similar structure is illustrated in (the lower portion of) Fig. 1 of Hamacher *et al.*:

Fig. 1. The fabrication process of position-sensitive germanium detectors.

Thus Hamacher *et al.* disclose (Fig. 1) a camera with a position-sensitive detector for measuring charged particles comprising a crystalline substrate formed of semiconductor material (*e.g.*, high-purity germanium) and a surface region, the surface region including a plurality of electrodes formed by a structured metallic layer comprising aluminum (*i.e.*, “Al” in Fig. 1), wherein the structure of the metallic layer

continues at least partially into the crystalline substrate (see “transferring the structure into the semiconductor material by etching” in Fig. 1).

Hamacher *et al.* also teach or suggest that <u>no</u> passivation layer was provided or required between adjacent pairs of the plurality of electrodes (*e.g.*, see Fig. 1).

Hamacher *et al.* further teach or suggest that <u>each</u> of the plurality of electrodes comprise a boron doped layer (*e.g.*, see the fabrication process illustrated in Fig. 1). However, the detector of Hamacher *et al.* lacks that the boron doped layer can be substituted by an equivalent undoped amorphous (germanium or silicon) layer.

<u>Luke *et al.*</u>

Luke *et al.* state (pg. 590) that “ ... Semiconductor nuclear radiation detectors are usually operated in a full depletion mode and blocking contacts are required to maintain low leakage currents and high electric fields for charge collection. Blocking contacts on Ge detectors typically consist of n-type contacts formed by lithium diffusion and p-type contacts formed by boron ion implantation … alternative to the contacts discussed above are amorphous semiconductor contacts. The first experimental study of electrical junctions between amorphous Ge (a-Ge) and crystalline Ge was published in 1964 … More recently, a-Si, produced by chemical vapor deposition, was successfully used to fabricate blocking contacts-on Si to produce position sensitive detectors … Preliminary results show sputtered a-Ge contacts can be used as blocking contacts on Ge radiation detectors with potential advantages over conventional contacts”. The key phrase is “alternative”. Thus Luke *et al.* teach or suggest that blocking contacts for semiconductor nuclear radiation detectors are selected from one of the following equivalent blocking contacts: a boron doped layer, amorphous silicon layer, or amorphous germanium layer.

Luke *et al.* also state (pg. 593) that because " ... the a-Ge coating used for contact formation is the same as that used for surface passivation, both can be accomplished in one processing step, eliminating the need for additional surface treatments after the contacts are formed ... ". Thus Luke *et al.* also teach or suggest that the same processing step can be used to provide a passivation layer between adjacent pairs of the plurality of electrodes (*e.g.*, see Fig. 8). That is, Luke *et al.* teach or suggest at least two different and separate uses for an amorphous germanium layer: (a) in combination with a metallic layer to form a blocking contact; and (b) to form a passivation layer (*e.g.*, between contacts as illustrated in Fig. 8).

Hamacher *et al.* in view of Luke *et al.*

It should be noted that "when a patent claims a structure already known in the prior art that is altered by the mere substitution of one element for another known in the field, the combination must do more than yield a predictable results". *KSR International Co. v. Teleflex Inc.,* 550 U.S. ___, 82 USPQ2d 1385 (2007) at 1395 (citing *United States v. Adams*, 383 U.S. 39, 40 [148 USPQ 479] (1966)). See MPEP § 2143. In this case, one of ordinary skill in the art could have substituted an amorphous (germanium or silicon) layer for the boron doped layer in each of the plurality of electrodes of Hamacher *et al.* and the results of the substitution would have been predictable. Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to provide an undoped amorphous (germanium or silicon) germanium layer instead of the boron doped layer for each of the plurality of electrodes of Hamacher *et al.*

C1.

Appellant argues that the declaration of Protic was submitted to rebut the particular motivation of providing Hamacher *et al.* with a good blocking contact. Examiner respectfully disagrees. The 15 April 2008 office action states (first paragraph on pg. 5) that "Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to provide an undoped amorphous germanium layer instead of the boron doped layer for each of the plurality of blocking contacts in the detector of Hamacher *et al.*". Thus it is clear that the motivation was not an improved blocking contact. There was no finding in the 15 April 2008 office action that a particular equivalent blocking contact provides some advantage (*e.g.*, is a better blocking contact) over another equivalent blocking contact. That is, the rationale is simply to use a known <u>alternative</u>. Further, Luke *et al.* was cited as teaching (section 1) to apply an undoped germanium amorphous layer (that forms "good bipolar" blocking contacts) on a p- or n-doped germanium crystalline semiconductor structure as an <u>equivalent alternative</u> to a boron doped layer. One of ordinary skill in the art could have substituted an amorphous (germanium or silicon) layer for the boron doped layer in <u>each</u> of the plurality of electrodes of Hamacher *et al.* and the results of the substitution would have been predictable. Therefore, the declaration of Protic fails to rebut the particular rational (using a known <u>alternative</u>) to combine Luke *et al.* with Hamacher *et al.*

Appellant also argues that the declaration of Protic was submitted to establish the belief that the use of amorphous Germanium would degrade the energy resolution of a detector. First it is noted that this argument rest on the unsupported and

unexplained assumption that all radiation detector applications require a particular energy resolution. On the contrary, the desired energy resolution depends on the desired radiation detector application. For example, energy resolution is relatively unimportant in applications wherein only the distribution (*i.e.*, positions) of the charged particles are measured. Thus the criteria for selecting from a list of known equivalents would depend on the desired radiation detector application. Appellant have not provided any evidence or explanation that the criteria for selecting from a list of known equivalents must be energy resolution for all radiation detector applications. Therefore, appellant's arguments are not persuasive.

Appellant also argues that no motivation to combine Luke *et al.* with Hamacher *et al.* since there was an active disbelief that the invention would work (since an amorphous Germanium contact was expected to decrease the energy resolution). First it is noted that this argument rest on the unsupported and unexplained assumption that for a detector to “work”, the detector must have a particular energy resolution. As discussed above, the desired energy resolution depends on the desired radiation detector application. A detector works if it is able to make the desired measurements (*e.g.*, measurements of charged particles positions). Further, the detectors referred to (on pg. 5 of the instant specification and pg. 889 of Attachment 2) by appellant comprise: an a-Ge blocking contact and an a-Ge coating on exposed surfaces between the blocking contacts. Thus the evidence cited by appellant only support a conclusion that some embodiments of detectors comprising an a-Ge blocking contact and an a-Ge coating on exposed surfaces between the blocking contacts have an energy resolution

that is potentially degraded. The evidence cited by appellant does not support a conclusion that the potential degradation of the energy resolution is due to the a-Ge blocking contacts. On the contrary, Hansen *et al.* teach (see Fig. 7) that there is a higher leakage current at a given temperatures for “a-Ge:H” (as compared to “CH_3OH”) due to an a-Ge coating on the exposed surfaces between the p+ and n+ contacts. Moreover even if there is a decrease in energy resolution due to a-Ge blocking contacts, other advantages of a-Ge blocking contacts may be more important than energy resolution for a particular application. Therefore, appellant's arguments are not persuasive.

C2.

Appellant argues that Hamacher *et al.* do not teach or suggest the more specific 20 μm since Hamacher *et al.* only disclose less than 100 μm. Examiner respectfully disagrees. Dependent claim 11 recites “the mutual spacing is less than 20 μm”. MPEP § 2144.05 indicates that in the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a *prima facie* case of obviousness exists. In this case, Hamacher *et al.* state (pg. 129) that the “ ... grooves have a width of less than 100 μm ... ”. Thus, the claimed range of “less than 20 μm” is within the range “less than 100 μm” disclosed by the prior art. Therefore, the cited prior art teach or suggest “less than 20 μm” as recited in dependent claim 11.

D.

Appellant argues that wherein “the amorphous layer is not doped” as recited in amended claim 8 is supported by the specification as filed since the specification

discloses application of an amorphous Germanium layer by sputtering or vapor deposition followed by the application of a metal layer at page 6, line 31 to page 7, line 9. Examiner respectfully disagrees. Each claim limitation must be expressly, implicitly, or inherently supported in the originally filed disclosure (MPEP § 2163.05). The specification states (pg. 6, line 11 to pg. 7, line 10) that "Very good results have been achieved with an amorphous layer made of germanium. … The crystalline region beneath the amorphous layer then preferably also consists of germanium. … The amorphous layer is always applied to a semiconductor material. The amorphous layer therefore provides an electrical conductivity, which is substantially smaller than the conductivity of the material disposed beneath the amorphous layer. In one exemplary embodiment for the manufacture of the invention, an amorphous germanium layer is initially applied by sputtering or vapour deposition. … metallic layer … is subsequently applied by vapour deposition. … Grooves are etched in the amorphous germanium-metallic layer to such a depth that they extend at least into the germanium crystal region … ". Thus there does <u>not</u> appear to be any express disclosure of doping the deposited amorphous germanium layer. However, there also does <u>not</u> appear to be any express disclosure that the amorphous germanium layer initially applied by sputtering or vapour deposition is <u>undoped</u>. Thus the issue is: does sputtering or vapour deposition of an amorphous germanium layer implicitly or inherently require that the deposited amorphous germanium layer is <u>undoped</u>. It is noted that appellant has failed to provide any evidence or arguments that sputtering or vapor deposition implicitly or inherently forms an amorphous Germanium layer that is undoped. Further, the cited prior art teaches that a doped amorphous Germanium layer is formed using a RF sputterer with a Ge target and a gas mixture of 7% hydrogen in

argon (*e.g.*, see section II "CONTACT FABRICATION" of Luke *et al.*). Thus the cited prior art of record clearly shows that sputtering or vapour deposition of an amorphous germanium layer does not implicitly or inherently require that the deposited amorphous germanium layer is undoped. Therefore to one having ordinary skill in the art, a description of a "subsequently" applied metal electrode does not imply or require that the Germanium layer initially applied by sputtering or vapor deposition must be undoped.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/David P. Porta/

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